ASTR-ASTRONOMY (ASTR)

ASTR 105G. The Planets
4 Credits (3+2P)
Comparative study of the planets, moons, comets, and asteroids which comprise the solar system. Emphasis on geological and physical processes which shape the surfaces and atmospheres of the planets. Laboratory exercises include analysis of images returned by spacecraft. Intended for non-science majors, but some basic math required. This lecture/lab course satisfies the New Mexico Common Core Area III: Lab Sciences requirement.

ASTR 110G. Introduction to Astronomy
4 Credits (3+2P)
A survey of the universe. Observations, theories, and methods of modern astronomy. Topics include planets, stars and stellar systems, black holes and neutron stars, supernovas and gaseous nebulae, galaxies and quasars, and cosmology. Emphasis on physical principles involving gravity, light and optics (telescopes). Generally non-mathematical. Laboratory involves use of the campus observatory and exercises designed to experimentally illustrate principles of astronomy. This lecture/lab course satisfies the New Mexico Common Core Area III: Lab Sciences requirement.

ASTR 199. Introduction to Astronomy Lab, Special 1 Credit
This lab-only listing exists only for students who may have transferred to NMSU having taken a lecture-only introductory astronomy class, to allow them to complete the lab requirement to fulfill the general education requirement. Consent of Instructor required. Restricted to Las Cruces campus only.
Prerequisite(s): Must have passed Introduction to Astronomy lecture-only (e.g.

ASTR 301V. Revolutionary Ideas in Astronomy
3 Credits
Examines recent fundamental scientific revolutions that have shaped our view of Earth and the universe. Topics in astronomy range from exoplanets to black holes to dark energy and raise questions about the very nature of how we use the scientific method to see the unseen, and how this shapes science research today.
Prerequisite(s): Any general education science course.

ASTR 305V. The Search for Life in the Universe
3 Credits
Use of information from several of the sciences to explore the likelihood that life exists elsewhere in the universe. Subjects include an overview of historical ideas about the possibility of life elsewhere in the universe, the chemistry and biology of life on Earth, recent explorations for life within our solar system, and current search strategies for life in the universe and their scientific basis.

ASTR 308V. Into the Final Frontier
3 Credits
Exploration of space: a brief review of the history of space flight, the Apollo program, joint U.S.-Soviet space missions, and unstaffed exploration of the planets. Emphasis on knowledge gained through these efforts. Includes new space initiatives. Same as HON 308V.

ASTR 330V. Planetary Exploration
3 Credits
A current planetary exploration mission is studied within the context of the solar system. The data acquired and principles involved in executing the mission, as well as political and economic implications of planetary exploration, are examined. Same as HON 330V. Main campus only.

ASTR 400. Undergraduate Research
1-3 Credits
Supervised individual study or research. May be repeated for a maximum of 6 credits.
Prerequisite: consent of instructor.

ASTR 401. Topics in Modern Astrophysics
3 Credits
This course is designed for students interested in astrophysics who have some background in math and physics and want to learn about basic astrophysics and interesting current topics. The course will cover basic astrophysical concepts such as orbital mechanics, light, and radiative processes and transfer. These concepts will be applied to the discussion of exciting modern topics involving planets, exoplanets, stars, galaxies, and/or cosmology, with topical emphasis determined by the instructor.
Prerequisite(s): MATH 192G and (PHYS 213 or PHYS 215G).

ASTR 402. Introduction to Astronomical Observations and Techniques
3 Credits
Designed for students interested in astrophysics who have some background in math and astronomy and want to learn about techniques for obtaining and analyzing astronomical data. This course will review the properties of light and discuss the process of experimental design. The course will describe basic observational tools such as telescopes and detectors. It will discuss how data is obtained, and how features of the detector and the Earth’s atmosphere can be corrected for. Some topics in basic astronomical data analysis will be discussed, with topical emphasis determined by the instructor. Some simple data analysis projects will be assigned.
Prerequisite(s): MATH 191G and (PHYS 214 or PHYS 216G) and (ASTR 105, ASTR 110, or ASTR 401).

ASTR 405. Astronomy and Astrophysics I
3 Credits
Application of physical principles to problems in modern astronomy. Emphasis on radiation mechanisms and radiation transfer in astronomical systems. No S/U grading. Same as ASTR 505 with less advanced work.
Prerequisite: consent of instructor.

ASTR 406. Stellar Dynamics and Hydrodynamics
3 Credits
Undergraduate cross-listing of graduate class on basic stellar dynamics and principles of hydrodynamics. Consent of Instructor required.
Prerequisite(s): Consent of instructor.

ASTR 435. Observational Techniques I
3 Credits
Up-to-date introduction to modern observational astronomy. Includes computers, data analysis, optical telescopes, optical and infrared photometry, image processing, and detection. No S/U grading. Same as ASTR 535 with less advanced work.
Prerequisite: consent of instructor.

ASTR 500. Seminar
1 Credit
Organized group study treating selected topics.
ASTR 505. Astronomy and Astrophysics I (f)  
3 Credits  
Application of physical principles to problems in modern astronomy. Emphasis will be on radiation mechanisms and radiation transfer in astronomical systems.  
Prerequisite: consent of instructor.

ASTR 506. Stellar Dynamics and Hydrodynamics  
3 Credits  
Graduate level course on basic stellar dynamics and fundamentals of hydrodynamics.

ASTR 535. Observational Techniques I (f)  
3 Credits  
Up-to-date introduction to modern observational astronomy in a two-semester sequence. Topics include: introduction to computers, error analysis in data, the different types of optical telescopes, and optical and infrared photometry, image processing, and detectors.

ASTR 536. Observational Techniques in Astronomy II (s)  
3 Credits  
Sequel to ASTR 535. The second half of the course emphasizes observational techniques in spectroscopy, radio astronomy, and high energy astrophysics.  
Prerequisite: ASTR 535.

ASTR 545. Stellar Spectroscopy  
3 Credits  
This course covers the physics of stellar atmospheres with emphasis on using spectra as a diagnostic tool for understanding the properties of stars. Topics include spectral classification, radiative transfer, gas equilibrium physics, line and continuum opacities, adiabatic and superadiabatic convection, and extraction of observed quantities from spectra for deducing physical conditions of the source.

ASTR 555. Galaxies I  
3 Credits  
Fundamentals of the properties of galaxies and the components that they are made of stars and stellar populations, gas and dust, central black holes, and dark matter. Introduction to basic concepts of galaxy formation.

ASTR 565. Stellar Interiors  
3 Credits  
Internal constitutions of stars, computation of stellar models, and stellar evolution.

ASTR 575. Computational Astrophysics  
3 Credits  
Scientific programming for astronomical applications. Explore key algorithms and standard techniques for astronomical data analysis. Topics may include pointers, data structures, dynamic memory allocation, least squares fitting, grid and iterative search methods, LCG random number generators, Monte Carlo simulations, numerical integration, and astronomical image and spectrum manipulation. Applications to real astronomical datasets are emphasized.

ASTR 598. Special Research Programs  
1-6 Credits  
Individual investigations, either analytical or experimental.

ASTR 599. Master's Thesis  
15 Credits  
Master's level research in astrophysics or observational astronomy.

ASTR 600. Pre-dissertation Research  
1-15 Credits  
Research.

ASTR 605. Interstellar Medium  
3 Credits  
Problems associated with gas and dust in the galaxy and with diffuse and planetary nebulae.

ASTR 610. Radio Astronomy  
3 Credits  
Techniques and observations stressing the operational approach to measurement and how the observations are intimately interwoven throughout modern astrophysics.

ASTR 616. Galaxies II  
3 Credits  
Advanced topics in galaxies. Includes a detailed description and understanding of the Milky Way and topics in galaxy formation and evolution.

ASTR 620. Planetary Science I  
3 Credits  
Evaluation and analysis of observational data on solar system objects to determine their nature and physical conditions, with emphasis upon atmospheres (composition, structure, thermodynamics, evolution, etc.)

ASTR 621. Planetary Science II  
3 Credits  
The physical processes involved in planetary system formation are addressed. Specific foci include molecular cloud collapse, disk processes, and competing theories of planet formation within disks. Additional topics to be discussed may include: the solar wind, planetary magnetic fields, planetary ring processes, and mineralogy.

ASTR 625. Cosmology  
3 Credits  
Discussion of our current knowledge of the structure of the universe and current research methods. Topics include the distance scale, clustering of galaxies, large-scale structure, metrics, dark matter, and cosmological probes such as distant quasars, radio galaxies, and gravitational lenses.

ASTR 630. Methods of Statistical Analysis for Modern Astronomy  
3 Credits  
Graduate class for students interested in applying statistical techniques to modern astrophysical data sets. Topics include a review of probability and probability distribution functions, implications of techniques for statistical inference, regression and multivariate analysis, data smoothing, data mining, survival analysis and time domain analysis. Applications to real astronomical data sets will be emphasized with all topics.

ASTR 670. Heliophysics  
3 Credits  
Explore the Sun and its processes, the heliosphere, and its interactions with the planets. Topics include: A introductory description of space weather and its physics; energy interaction with the space environment; the quiet Sun and its interactions with planetary atmospheres (with an emphasis on Earth); Magnetohydrodynamics; frozen-in flux; the solar wind; magnetized fluid dynamics; the active Sun(flares and coronal mass ejections); the effects of Space Weather.

ASTR 698. Special Topics.  
1-9 Credits  
Special topics.

ASTR 700. Doctoral Dissertation  
15 Credits  
Dissertation.